



# SEQUENCE LISTING

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<120> GEMINIVIRUS RESISTANT TRANSGENIC PLANTS

<130> 5051.458IP

<140> US 10/633,850

<141> 2003-08-04

<150> US 09/289,346

<151> 1999-04-09

<150> US 60/125,004

<151> 1999-03-18

<160> 113

<170> PatentIn version 3.3

<210> 1

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Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
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Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
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Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
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Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Ala Ala Ala Ile Pro Glu Lys  
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Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Ala Ala  
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Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
20 25 30

Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Ala Phe Ala Ala Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
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Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Ala Leu Ala Ala Ile Phe

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55

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Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
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Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
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Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Gly Cys Ala Ala Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
20 25 30

Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Ala Ala Ala Ala Glu Ala Leu Asn Ala Ser  
20 25 30

Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
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Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Ala Leu Ala Ala Ser  
 20 25 30

Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
 35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
 50 55 60

Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
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Ser Ala Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
 35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
20 25 30

Ser Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Ala Thr Pro Ala Pro  
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 Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
                     20                      25                      30  
 Ser Ala Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
                     35                      40                      45  
 Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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 Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
                     20                      25                      30

Ser Lys Ala Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
                     35                      40                      45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser
          20          25          30

Ser Lys Glu Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys
          35          40          45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe
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Asp Lys Thr Pro Glu Pro
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser
          20          25          30

Ser Lys Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys
          35          40          45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe
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Ser Lys Glu Glu Tyr Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Gly Cys Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser  
20 25 30

Ser Lys Glu Glu Ala Ala Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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Asp Lys Thr Pro Glu Pro  
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20 25 30

Ser Lys Glu Glu Ala Val Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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20 25 30

Ser Lys Glu Glu Ala Gly Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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20 25 30

Ser Lys Glu Glu Ala Leu Gln Ala Ala Arg Glu Lys Ile Pro Glu Lys  
35 40 45

Tyr Leu Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe  
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 <223> Mutagenesis oligonucleotide for II151  
  
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 tttctctcta gctgcctgaa gggcttcttc tttggaaga 39

<210> 50  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> misc\_feature  
 <222> (1)..(1056)  
 <223> TGMV AL1 coding sequence

<400> 50  
 atgccatcgc atccaaaacg gtttcaaata aatgccaaaa attattttct tacatatacct 60  
 cagtgtctct tgtccaaaga agaatacactt tctcaattac aagccctaaa cactccgatt 120  
 aacaaaaaat tcataaaaat ctgcagagag cttcatgaag atgggcaacc tcacctccac 180  
 gtgottattc agttcgaggg aaaatactgc tgccaaaatc aacgattctt cgacctggta 240  
 tccccaaaca ggtcagcaca tttccatcca aacattcaga gagctaaatc gtcttccgac 300  
 gtcaagacgt acatcgacaa agacggagat actcttgtat ggggagaatt ccaggtcgac 360  
 ggtcgaagtg ctagaggagg ttgccaaaca tctaacgacg ctgcagcaga ggcgttaaatt 420  
 gcttcttcca aagaagaagc cctgcagata attagagaga aaatcccaga aaaatattta 480  
 tttcagttcc acaatctaaa tagcaattta gataggatat ttgataagac tcctgaacca 540  
 tggtctctc cgttccacgt ctcatcattt actaacgtgc cagacgagat gagacaatgg 600  
 gctgaaaatt attttggaag gagttccgct gcgcggccgg agagacctat tagtattatc 660  
 atcgagggcg atagtcggac gggaaagact atgtgggctc gttcactagg cccacataat 720  
 tatttgagcg ggcatttgga tctcaattct agggtttact caaacaaggt tgagtataac 780  
 gtcacgatg atgtcacacc gcaatatcta aagttgaaac attggaaaga actcattggg 840  
 gcccaaagag attggcagac taactgtaaa tacggaaagc cagttcaaat taaaggaggt 900  
 atcccgtaa tcgtgctgtg caatcctgga gagggtgcta gctataaagt tttcctcgac 960  
 aaagaggaaa aactccact aaagaactgg actttccata atgcgaaatt cgtcttctc 1020  
 aactcccccc tctatcaaag ctcaacacag agcagc 1056

<210> 51  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>

<221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 FQ118 mutant (Ala13)

<400> 51

atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt	48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe	
1 5 10 15	
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa	96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	
20 25 30	
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc	144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	
35 40 45	
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag	192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	
50 55 60	
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa gcc gcg gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Ala Ala Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	

tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 52  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 52

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln
20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys
35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln
---



50	55	60
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val		
65	70	75 80
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys		
	85	90 95
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu		
	100	105 110
Val Trp Gly Glu Ala Ala Val Asp Gly Arg Ser Ala Arg Gly Gly Cys		
	115	120 125
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys		
	130	135 140
Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu		
145	150	155 160
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys		
	165	170 175
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn		
	180	185 190
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser		
	195	200 205
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp		
210	215	220
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn		
225	230	235 240
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys		
	245	250 255
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu		
	260	265 270
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn		
	275	280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 53  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 D120 (Ala14) mutant

<400> 53  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

gta tgg gga gaa gcc gcg gtc gcc ggc cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Ala Ala Val Ala Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 54  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 54

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Ala Ala Val Ala Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn

180                                      185                                      190  
 Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
           195                                      200                                      205  
 Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
           210                                      215                                      220  
 Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225                                      230                                      235                                      240  
 Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
                                     245                                      250                                      255  
 Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
                                     260                                      265                                      270  
 Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
                                     275                                      280                                      285  
 Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
           290                                      295                                      300  
 Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305                                      310                                      315                                      320  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
                                     325                                      330                                      335  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
                                     340                                      345                                      350

<210> 55  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 RS-R125 (Ala1) mutant

<400> 55  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe

48

1	5	10	15	
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa				96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	20	25	30	
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc				144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	35	40	45	
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag				192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	50	55	60	
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta				240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	65	70	75	80
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa				288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	85	90	95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt				336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	100	105	110	
gta tgg gga gaa ttc cag gtc gac ggt gcg gcc gct gca gga ggt tgc				384
Val Trp Gly Glu Phe Gln Val Asp Gly Ala Ala Ala Ala Gly Gly Cys	115	120	125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa				432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	130	135	140	
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta				480
Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	145	150	155	160
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag				528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	165	170	175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac				576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	180	185	190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt				624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	195	200	205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat				672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	210	215	220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat				720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	225	230	235	240

tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 56  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 56

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe	
1 5 10 15	
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	
20 25 30	
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	
35 40 45	
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	
50 55 60	
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Ala Ala Ala Ala Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp



Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
305 310 315 320  
325 330 335

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<210> 57
<211> 1056
<212> DNA
<213> Tomato golden mosaic virus
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<400>	57															
atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt																48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe																
1	5				10						15					
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa																96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln																
	20				25						30					
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc																144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys																
	35				40						45					
aga gag ctt cat gaa gat ggg caa cct cac ctg cac gtg ctt att cag																192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln																
	50				55						60					
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta																240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val																
65	70				75						80					
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa																288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys																
	85				90						95					
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt																336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu																
	100				105						110					
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc																384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys																
	115				120						125					
gca gct agc aac gac gct gca gca gag gcg tta aat gct tct tcc aaa																432
Ala Ala Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys																

130	135	140	
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu 145 150 155 160			480
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys 165 170 175			528
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn 180 185 190			576
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser 195 200 205			624
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp 210 215 220			672
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn 225 230 235 240			720
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys 245 250 255			768
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu 260 265 270			816
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn 275 280 285			864
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile 290 295 300			912
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp 305 310 315 320			960
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys 325 330 335			1008
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser 340 345 350			1056

<210> 58  
<211> 352

<212> PRT

<213> Tomato golden mosaic virus

<400> 58

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
115 120 125

Ala Ala Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220  
 Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240  
 Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255  
 Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270  
 Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285  
 Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300  
 Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 59  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 ND133 (Ala3) mutant

<400> 59  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144

Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys		
		35					40					45					
aga	gag	ctt	cat	gaa	gat	ggg	caa	cct	cac	ctc	cac	gtg	ctt	att	cag	192	
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln		
	50					55					60						
ttc	gag	gga	aaa	tac	tgc	tgc	caa	aat	caa	cga	ttc	ttc	gac	ctg	gta	240	
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val		
65					70					75					80		
tcc	cca	aca	agg	tca	gca	cat	ttc	cat	cca	aac	att	cag	aga	gct	aaa	288	
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys		
				85					90					95			
tcg	tct	tcc	gac	gtc	aag	acg	tac	atc	gac	aaa	gac	gga	gat	act	ctt	336	
Ser	Ser	Ser	Asp	Val	Lys	Thr	Tyr	Ile	Asp	Lys	Asp	Gly	Asp	Thr	Leu		
			100					105					110				
gta	tgg	gga	gaa	ttc	cag	gtc	gac	ggt	cga	agt	gct	aga	gga	ggt	tgc	384	
Val	Trp	Gly	Glu	Phe	Gln	Val	Asp	Gly	Arg	Ser	Ala	Arg	Gly	Gly	Cys		
	115						120					125					
caa	aca	tct	gcg	gcc	gct	gca	gca	gag	gcg	tta	aat	gct	tct	tcc	aaa	432	
Gln	Thr	Ser	Ala	Ala	Ala	Ala	Ala	Glu	Ala	Leu	Asn	Ala	Ser	Ser	Lys		
	130					135					140						
gaa	gaa	gcc	ctg	cag	ata	att	aga	gag	aaa	atc	cca	gaa	aaa	tat	tta	480	
Glu	Glu	Ala	Leu	Gln	Ile	Ile	Arg	Glu	Lys	Ile	Pro	Glu	Lys	Tyr	Leu		
145					150					155					160		
ttt	cag	ttc	cac	aat	cta	aat	agc	aat	tta	gat	agg	ata	ttt	gat	aag	528	
Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Lys		
				165					170					175			
act	cct	gaa	cca	tgg	ctt	cct	ccg	ttc	cac	gtc	tca	tca	ttt	act	aac	576	
Thr	Pro	Glu	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn		
			180					185					190				
gtg	cca	gac	gag	atg	aga	caa	tgg	gct	gaa	aat	tat	ttt	gga	aag	agt	624	
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser		
	195						200					205					
tcc	gct	gcg	cgg	ccg	gag	aga	cct	att	agt	att	atc	atc	gag	ggc	gat	672	
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp		
	210					215					220						
agt	cgg	acg	gga	aag	act	atg	tgg	gct	cgt	tca	cta	ggc	cca	cat	aat	720	
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn		
225					230					235					240		
tat	ttg	agc	ggg	cat	ttg	gat	ctc	aat	tct	agg	gtt	tac	tca	aac	aag	768	
Tyr	Leu	Ser	Gly	His	Leu	Asp	Leu	Asn	Ser	Arg	Val	Tyr	Ser	Asn	Lys		
				245				250						255			
gtt	gag	tat	aac	gtc	atc	gat	gat	gtc	aca	ccg	caa	tat	cta	aag	ttg	816	
Val	Glu	Tyr	Asn	Val	Ile	Asp	Asp	Val	Thr	Pro	Gln	Tyr	Leu	Lys	Leu		

260	265	270	
aaa cat tgg aaa gaa ctc att	ggg gcc caa aga gat tgg	cag act aac	864
Lys His Trp Lys Glu Leu Ile	Gly Ala Gln Arg Asp Trp	Gln Thr Asn	
275	280	285	
tgt aaa tac gga aag cca gtt	caa att aaa gga ggt atc	ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val	Gln Ile Lys Gly Gly Ile	Pro Ser Ile	
290	295	300	
gtg ctg tgc aat cct gga gag	ggt gct agc tat aaa gtt	ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu	Gly Ala Ser Tyr Lys Val	Phe Leu Asp	
305	310	315 320	
aaa gag gaa aac act cca cta	aag aac tgg act ttc cat	aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu	Lys Asn Trp Thr Phe His	Asn Ala Lys	
325	330	335	
ttc gtc ttc ctc aac tcc ccc	ctc tat caa agc tca aca	cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro	Leu Tyr Gln Ser Ser Thr	Gln Ser Ser	
340	345	350	
<210> 60			
<211> 352			
<212> PRT			
<213> Tomato golden mosaic virus			
<400> 60			
Met Pro Ser His Pro Lys Arg	Phe Gln Ile Asn Ala Lys	Asn Tyr Phe	
1	5	10 15	
Leu Thr Tyr Pro Gln Cys Ser	Leu Ser Lys Glu Glu Ser	Leu Ser Gln	
20	25	30	
Leu Gln Ala Leu Asn Thr Pro	Ile Asn Lys Lys Phe Ile	Lys Ile Cys	
35	40	45	
Arg Glu Leu His Glu Asp Gly	Gln Pro His Leu His Val	Leu Ile Gln	
50	55	60	
Phe Glu Gly Lys Tyr Cys Cys	Gln Asn Gln Arg Phe Phe	Asp Leu Val	
65	70	75 80	
Ser Pro Thr Arg Ser Ala His	Phe His Pro Asn Ile Gln	Arg Ala Lys	
85	90	95	
Ser Ser Ser Asp Val Lys Thr	Tyr Ile Asp Lys Asp Gly	Asp Thr Leu	
100	105	110	

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
115 120 125

Gln Thr Ser Ala Ala Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 61  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 E--N140 (Ala4) mutant

<400> 61  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc 384  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 caa aca tct aac gac gct gca gcg gcc gcg tta gct gct tct tcc aaa 432  
 Gln Thr Ser Asn Asp Ala Ala Ala Ala Leu Ala Ala Ser Ser Lys  
 130 135 140  
 gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta 480  
 Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160  
 ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag 528



Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Lys	
				165					170					175		
act	cct	gaa	cca	tgg	ctt	cct	ccg	ttc	cac	gtc	tca	tca	ttt	act	aac	576
Thr	Pro	Glu	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn	
			180					185					190			
gtg	cca	gac	gag	atg	aga	caa	tgg	gct	gaa	aat	tat	ttt	gga	aag	agt	624
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser	
		195					200					205				
tcc	gct	gcg	cgg	ccg	gag	aga	cct	att	agt	att	atc	atc	gag	ggc	gat	672
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp	
	210					215					220					
agt	cgg	acg	gga	aag	act	atg	tgg	gct	cgt	tca	cta	ggc	cca	cat	aat	720
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn	
225					230				235						240	
tat	ttg	agc	ggg	cat	ttg	gat	ctc	aat	tct	agg	gtt	tac	tca	aac	aag	768
Tyr	Leu	Ser	Gly	His	Leu	Asp	Leu	Asn	Ser	Arg	Val	Tyr	Ser	Asn	Lys	
				245				250						255		
gtt	gag	tat	aac	gtc	atc	gat	gat	gtc	aca	ccg	caa	tat	cta	aag	ttg	816
Val	Glu	Tyr	Asn	Val	Ile	Asp	Asp	Val	Thr	Pro	Gln	Tyr	Leu	Lys	Leu	
			260					265					270			
aaa	cat	tgg	aaa	gaa	ctc	att	ggg	gcc	caa	aga	gat	tgg	cag	act	aac	864
Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn	
		275					280					285				
tgt	aaa	tac	gga	aag	cca	gtt	caa	att	aaa	gga	ggg	atc	ccg	tca	atc	912
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile	
	290					295					300					
gtg	ctg	tgc	aat	cct	gga	gag	ggg	gct	agc	tat	aaa	gtt	ttc	ctc	gac	960
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp	
305					310				315						320	
aaa	gag	gaa	aac	act	cca	cta	aag	aac	tgg	act	ttc	cat	aat	gcg	aaa	1008
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys	
				325				330						335		
ttc	gtc	ttc	ctc	aac	tcc	ccc	ctc	tat	caa	agc	tca	aca	cag	agc	agc	1056
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser	
			340					345					350			

<210> 62  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus  
  
 <400> 62

Met	Pro	Ser	His	Pro	Lys	Arg	Phe	Gln	Ile	Asn	Ala	Lys	Asn	Tyr	Phe
1				5					10					15	

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Ala Ala Leu Ala Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
340 345 350

<210> 63  
<211> 1056  
<212> DNA  
<213> Tomato golden mosaic virus

<220>  
<221> CDS  
<222> (1)..(1056)  
<223> TGMV AL1 KEE146 (Ala5) mutant

<400> 63  
atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
1 5 10 15  
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
20 25 30  
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
35 40 45  
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
50 55 60

ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc gcg	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Ala	
130 135 140	
gcc gca gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac 960  
 Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa 1008  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 64  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 64

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Ala  
 130 135 140

Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 65  
 <211> 1056  
 <212> DNA

<213> Tomato golden mosaic virus

<220>

<221> CDS

<222> (1)..(1056)

<223> TGMV AL1 REK154 (Ala6) mutant

<400> 65

atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt	48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe	
1 5 10 15	

ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa	96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	
20 25 30	

tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc	144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	
35 40 45	

aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag	192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	
50 55 60	

ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	

tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	

tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	

gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	

caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	

gaa gaa gcc ctg cag ata att gcg gcc gca atc cca gaa aaa tat tta	480
Glu Glu Ala Leu Gln Ile Ile Ala Ala Ala Ile Pro Glu Lys Tyr Leu	
145 150 155 160	

ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	

act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	

gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 66  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 66

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln
20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys



35	40	45
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln 50 55 60		
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val 65 70 75 80		
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys 85 90 95		
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu 100 105 110		
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys 115 120 125		
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys 130 135 140		
Glu Glu Ala Leu Gln Ile Ile Ala Ala Ala Ile Pro Glu Lys Tyr Leu 145 150 155 160		
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys 165 170 175		
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn 180 185 190		
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser 195 200 205		
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp 210 215 220		
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn 225 230 235 240		
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys 245 250 255		
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu 260 265 270		

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 67  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 EKY159 (Ala7) mutant

<400> 67  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gcg gcc gct tta	480
Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Ala Ala Ala Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	

aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa 1008  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
                   325                  330                  335

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
                   340                  345                  350

<210> 68  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus  
 <400> 68

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1                  5                  10                  15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
                   20                  25                  30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
                   35                  40                  45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
                   50                  55                  60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65                  70                  75                  80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
                   85                  90                  95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
                   100                  105                  110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
                   115                  120                  125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
                   130                  135                  140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Ala Ala Ala Leu  
 145                  150                  155                  160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys



<400> 69

atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt	48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe	
1 5 10 15	
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa	96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	
20 25 30	
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc	144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	
35 40 45	
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag	192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	
50 55 60	
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt gcg ttc gcc gct cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Ala Phe Ala Ala Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	

agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat 720  
 Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag 768  
 Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg 816  
 Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac 864  
 Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc 912  
 Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac 960  
 Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa 1008  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 70  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 70

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140  
 Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160  
 Phe Ala Phe Ala Ala Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175  
 Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190  
 Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205  
 Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220  
 Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240  
 Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255  
 Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270  
 Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285  
 Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile



290		295		300	
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp					
305		310		315	320
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys					
		325		330	335
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser					
		340		345	350
<210>	71				
<211>	1056				
<212>	DNA				
<213>	Tomato golden mosaic virus				
<220>					
<221>	CDS				
<222>	(1)..(1056)				
<223>	TGMV AL1 N-DR172 (Ala9) mutant				
<400>	71				
atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt					48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe					
1		5		10	15
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa					96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln					
		20		25	30
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc					144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys					
		35		40	45
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag					192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln					
		50		55	60
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta					240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val					
65		70		75	80
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa					288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys					
		85		90	95
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt					336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu					
		100		105	110
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc					384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys					

115	120	125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys 130 135 140			432
gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu 145 150 155 160			480
ttt cag ttc cac aat cta aat agc gcg cta gct gcg ata ttt gat aag Phe Gln Phe His Asn Leu Asn Ser Ala Leu Ala Ala Ile Phe Asp Lys 165 170 175			528
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn 180 185 190			576
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser 195 200 205			624
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp 210 215 220			672
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn 225 230 235 240			720
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys 245 250 255			768
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu 260 265 270			816
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn 275 280 285			864
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile 290 295 300			912
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp 305 310 315 320			960
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys 325 330 335			1008
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser 340 345 350			1056

<210> 72  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 72

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Ala Leu Ala Ala Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 73  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 K--E179 (Ala10) mutant

<400> 73  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96

Leu	Thr	Tyr	Pro	Gln	Cys	Ser	Leu	Ser	Lys	Glu	Glu	Ser	Leu	Ser	Gln		
			20					25					30				
tta	caa	gcc	cta	aac	act	ccg	att	aac	aaa	aaa	ttc	ata	aaa	atc	tgc	144	
Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys		
		35					40					45					
aga	gag	ctt	cat	gaa	gat	ggg	caa	cct	cac	ctc	cac	gtg	ctt	att	cag	192	
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln		
	50					55					60						
ttc	gag	gga	aaa	tac	tgc	tgc	caa	aat	caa	cga	ttc	ttc	gac	ctg	gta	240	
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val		
65					70					75					80		
tcc	cca	aca	agg	tca	gca	cat	ttc	cat	cca	aac	att	cag	aga	gct	aaa	288	
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys		
				85					90					95			
tcg	tct	tcc	gac	gtc	aag	acg	tac	atc	gac	aaa	gac	gga	gat	act	ctt	336	
Ser	Ser	Ser	Asp	Val	Lys	Thr	Tyr	Ile	Asp	Lys	Asp	Gly	Asp	Thr	Leu		
			100					105					110				
gta	tgg	gga	gaa	ttc	cag	gtc	gac	ggt	cga	agt	gct	aga	gga	ggt	tgc	384	
Val	Trp	Gly	Glu	Phe	Gln	Val	Asp	Gly	Arg	Ser	Ala	Arg	Gly	Gly	Cys		
		115					120					125					
caa	aca	tct	aac	gac	gct	gca	gca	gag	gcg	tta	aat	gct	tct	tcc	aaa	432	
Gln	Thr	Ser	Asn	Asp	Ala	Ala	Ala	Glu	Ala	Leu	Asn	Ala	Ser	Ser	Lys		
		130				135					140						
gaa	gaa	gcc	ctg	cag	ata	att	aga	gag	aaa	atc	cca	gaa	aaa	tat	tta	480	
Glu	Glu	Ala	Leu	Gln	Ile	Ile	Arg	Glu	Lys	Ile	Pro	Glu	Lys	Tyr	Leu		
145					150					155					160		
ttt	cag	ttc	cac	aat	cta	aat	agc	aat	tta	gat	agg	ata	ttt	gat	gcg	528	
Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Ala		
				165					170					175			
act	ccg	gcg	cca	tgg	ctt	cct	ccg	ttc	cac	gtc	tca	tca	ttt	act	aac	576	
Thr	Pro	Ala	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn		
			180					185					190				
gtg	cca	gac	gag	atg	aga	caa	tgg	gct	gaa	aat	tat	ttt	gga	aag	agt	624	
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser		
		195					200					205					
tcc	gct	gcg	cgg	ccg	gag	aga	cct	att	agt	att	atc	atc	gag	ggc	gat	672	
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp		
		210				215					220						
agt	cgg	acg	gga	aag	act	atg	tgg	gct	cgt	tca	cta	ggc	cca	cat	aat	720	
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn		
225					230					235					240		
tat	ttg	agc	ggg	cat	ttg	gat	ctc	aat	tct	agg	gtt	tac	tca	aac	aag	768	
Tyr	Leu	Ser	Gly	His	Leu	Asp	Leu	Asn	Ser	Arg	Val	Tyr	Ser	Asn	Lys		

245										250										255										
gtt	gag	tat	aac	gtc	atc	gat	gat	gtc	aca	ccg	caa	tat	cta	aag	ttg		816													
Val	Glu	Tyr	Asn	Val	Ile	Asp	Asp	Val	Thr	Pro	Gln	Tyr	Leu	Lys	Leu															
260					265					270																				
aaa	cat	tgg	aaa	gaa	ctc	att	ggg	gcc	caa	aga	gat	tgg	cag	act	aac		864													
Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn															
275			280			285																								
tgt	aaa	tac	gga	aag	cca	gtt	caa	att	aaa	gga	ggg	atc	ccg	tca	atc		912													
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile															
290			295			300																								
gtg	ctg	tgc	aat	cct	gga	gag	ggg	gct	agc	tat	aaa	gtt	ttc	ctc	gac		960													
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp															
305			310			315			320																					
aaa	gag	gaa	aac	act	cca	cta	aag	aac	tgg	act	ttc	cat	aat	gcg	aaa		1008													
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys															
325				330				335																						
ttc	gtc	ttc	ctc	aac	tcc	ccc	ctc	tat	caa	agc	tca	aca	cag	agc	agc		1056													
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser															
340			345			350																								

<210> 74  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus  
  
 <400> 74

Met	Pro	Ser	His	Pro	Lys	Arg	Phe	Gln	Ile	Asn	Ala	Lys	Asn	Tyr	Phe
1				5					10					15	
Leu	Thr	Tyr	Pro	Gln	Cys	Ser	Leu	Ser	Lys	Glu	Glu	Ser	Leu	Ser	Gln
			20					25					30		
Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys
		35					40					45			
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln
	50					55					60				
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val
65					70					75				80	
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys
				85					90					95	

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Ala  
 165 170 175

Thr Pro Ala Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 75  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 AAA136 (Leu) mutant

<400> 75  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc 384  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 caa aca tct aac gac ctt cta cta gag gcc tta aat gct tct tcc aaa 432  
 Gln Thr Ser Asn Asp Leu Leu Leu Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140  
 gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta 480



Glu	Glu	Ala	Leu	Gln	Ile	Ile	Arg	Glu	Lys	Ile	Pro	Glu	Lys	Tyr	Leu	
145					150					155					160	
ttt	cag	ttc	cac	aat	cta	aat	agc	aat	tta	gat	agg	ata	ttt	gat	aag	528
Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Lys	
				165					170					175		
act	cct	gaa	cca	tgg	ctt	cct	ccg	ttc	cac	gtc	tca	tca	ttt	act	aac	576
Thr	Pro	Glu	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn	
			180					185					190			
gtg	cca	gac	gag	atg	aga	caa	tgg	gct	gaa	aat	tat	ttt	gga	aag	agt	624
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser	
		195					200					205				
tcc	gct	gcg	cgg	ccg	gag	aga	cct	att	agt	att	atc	atc	gag	ggc	gat	672
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp	
	210					215					220					
agt	cgg	acg	gga	aag	act	atg	tgg	gct	cgt	tca	cta	ggc	cca	cat	aat	720
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn	
225					230				235						240	
tat	ttg	agc	ggg	cat	ttg	gat	ctc	aat	tct	agg	gtt	tac	tca	aac	aag	768
Tyr	Leu	Ser	Gly	His	Leu	Asp	Leu	Asn	Ser	Arg	Val	Tyr	Ser	Asn	Lys	
				245					250					255		
gtt	gag	tat	aac	gtc	atc	gat	gat	gtc	aca	ccg	caa	tat	cta	aag	ttg	816
Val	Glu	Tyr	Asn	Val	Ile	Asp	Asp	Val	Thr	Pro	Gln	Tyr	Leu	Lys	Leu	
			260					265					270			
aaa	cat	tgg	aaa	gaa	ctc	att	ggg	gcc	caa	aga	gat	tgg	cag	act	aac	864
Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn	
		275					280					285				
tgt	aaa	tac	gga	aag	cca	gtt	caa	att	aaa	gga	ggt	atc	ccg	tca	atc	912
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile	
	290					295					300					
gtg	ctg	tgc	aat	cct	gga	gag	ggt	gct	agc	tat	aaa	gtt	ttc	ctc	gac	960
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp	
305					310				315						320	
aaa	gag	gaa	aac	act	cca	cta	aag	aac	tgg	act	ttc	cat	aat	gcg	aaa	1008
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys	
				325					330					335		
ttc	gtc	ttc	ctc	aac	tcc	ccc	ctc	tat	caa	agc	tca	aca	cag	agc	agc	1056
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser	
			340					345					350			

<210> 76  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 76

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
115 120 125

Gln Thr Ser Asn Asp Leu Leu Leu Glu Ala Leu Asn Ala Ser Ser Lys  
130 135 140

Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
340 345 350

<210> 77  
<211> 1056  
<212> DNA  
<213> Tomato golden mosaic virus

<220>  
<221> CDS  
<222> (1)..(1056)  
<223> TGMV AL1 E--N140 + KEE146 (Ala4+5) mutant

<400> 77  
atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
1 5 10 15  
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
20 25 30  
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
35 40 45

aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag	192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	
50 55 60	
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gcg gcc gcg tta gct gct tct tcc gcg	432
Gln Thr Ser Asn Asp Ala Ala Ala Ala Leu Ala Ala Ser Ser Ala	
130 135 140	
gcc gca gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864

Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn		
		275					280					285					
tgt	aaa	tac	gga	aag	cca	gtt	caa	att	aaa	gga	ggg	atc	ccg	tca	atc		912
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile		
	290					295				300							
gtg	ctg	tgc	aat	cct	gga	gag	ggg	gct	agc	tat	aaa	gtt	ttc	ctc	gac		960
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp		
305					310				315						320		
aaa	gag	gaa	aac	act	cca	cta	aag	aac	tgg	act	ttc	cat	aat	gcg	aaa		1008
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys		
			325					330					335				
ttc	gtc	ttc	ctc	aac	tcc	ccc	ctc	tat	caa	agc	tca	aca	cag	agc	agc		1056
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser		
			340					345					350				

<210> 78  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus  
 <400> 78

Met	Pro	Ser	His	Pro	Lys	Arg	Phe	Gln	Ile	Asn	Ala	Lys	Asn	Tyr	Phe		
1				5					10					15			
Leu	Thr	Tyr	Pro	Gln	Cys	Ser	Leu	Ser	Lys	Glu	Glu	Ser	Leu	Ser	Gln		
			20					25					30				
Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys		
	35						40					45					
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln		
	50					55					60						
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val		
65					70				75					80			
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys		
				85					90					95			
Ser	Ser	Ser	Asp	Val	Lys	Thr	Tyr	Ile	Asp	Lys	Asp	Gly	Asp	Thr	Leu		
			100					105					110				
Val	Trp	Gly	Glu	Phe	Gln	Val	Asp	Gly	Arg	Ser	Ala	Arg	Gly	Gly	Cys		
		115					120					125					

Gln Thr Ser Asn Asp Ala Ala Ala Ala Ala Leu Ala Ala Ser Ser Ala  
 130 135 140

Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 79  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 K144 mutant

<400> 79  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc 384  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc gcg 432  
 Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Ala  
 130 135 140  
 gaa gaa gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta 480  
 Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160  
 ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag 528  
 Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 80  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 80

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln



				20				25					30		
Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys
		35					40					45			
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln
	50					55					60				
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val
65					70					75					80
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys
				85					90					95	
Ser	Ser	Ser	Asp	Val	Lys	Thr	Tyr	Ile	Asp	Lys	Asp	Gly	Asp	Thr	Leu
			100					105					110		
Val	Trp	Gly	Glu	Phe	Gln	Val	Asp	Gly	Arg	Ser	Ala	Arg	Gly	Gly	Cys
		115					120					125			
Gln	Thr	Ser	Asn	Asp	Ala	Ala	Ala	Glu	Ala	Leu	Asn	Ala	Ser	Ser	Ala
	130					135					140				
Glu	Glu	Ala	Leu	Gln	Ile	Ile	Arg	Glu	Lys	Ile	Pro	Glu	Lys	Tyr	Leu
145					150					155					160
Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Lys
				165					170					175	
Thr	Pro	Glu	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn
			180					185					190		
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser
		195					200					205			
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp
	210					215					220				
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn
225					230					235					240
Tyr	Leu	Ser	Gly	His	Leu	Asp	Leu	Asn	Ser	Arg	Val	Tyr	Ser	Asn	Lys
				245					250					255	

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 81  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 E145 mutant

<400> 81  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gca gag gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Ala Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	

gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac 960  
 Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa 1008  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 82  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 82

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Ala Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu

145		150		155		160									
Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Lys
				165					170					175	
Thr	Pro	Glu	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn
			180					185						190	
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser
		195					200					205			
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp
	210					215					220				
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn
225					230					235					240
Tyr	Leu	Ser	Gly	His	Leu	Asp	Leu	Asn	Ser	Arg	Val	Tyr	Ser	Asn	Lys
				245					250					255	
Val	Glu	Tyr	Asn	Val	Ile	Asp	Asp	Val	Thr	Pro	Gln	Tyr	Leu	Lys	Leu
			260					265					270		
Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn
		275					280					285			
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile
	290					295					300				
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp
305					310					315					320
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys
				325					330					335	
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser
			340					345					350		

<210> 83  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

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<220>
<221> CDS
<222> (1)..(1056)
<223> TGMV AL1 E146 mutant

<400> 83
atg cca tgc cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt      48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1          5          10          15

ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa      96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln
20          25          30

tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc      144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys
35          40          45

aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag      192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln
50          55          60

ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta      240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val
65          70          75          80

tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa      288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys
85          90          95

tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt      336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu
100         105         110

gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc      384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys
115         120         125

caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa      432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys
130         135         140

gaa gca gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta      480
Glu Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu
145         150         155         160

ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag      528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys
165         170         175

act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac      576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn
180         185         190

gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt      624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser
195         200         205

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tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 84  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 84

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln
20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys
35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn



275		280		285
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile				
290		295		300
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp				
305		310		315
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys				
		325		330
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser				
		340		345
				350

<210> 85  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 EE146 mutant

<400> 85	
atg cca tgc cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt	48
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe	
1 5 10 15	
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa	96
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	
20 25 30	
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc	144
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	
35 40 45	
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag	192
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	
50 55 60	
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	

100	105	110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys 115 120 125			384
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys 130 135 140			432
gcg gcc gcc ctg cag ata att aga gag aaa atc cca gaa aaa tat tta Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu 145 150 155 160			480
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys 165 170 175			528
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn 180 185 190			576
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser 195 200 205			624
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp 210 215 220			672
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn 225 230 235 240			720
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys 245 250 255			768
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu 260 265 270			816
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn 275 280 285			864
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile 290 295 300			912
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp 305 310 315 320			960
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys 325 330 335			1008

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 86  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 86

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Ala Ala Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
340 345 350

<210> 87  
<211> 1056  
<212> DNA  
<213> Tomato golden mosaic virus

<220>  
<221> CDS  
<222> (1)..(1056)  
<223> TGMV AL1 A147Y mutant

<400> 87  
atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt

48

Met	Pro	Ser	His	Pro	Lys	Arg	Phe	Gln	Ile	Asn	Ala	Lys	Asn	Tyr	Phe		
1				5					10					15			
ctt	aca	tat	cct	cag	tgc	tcc	ttg	tcc	aaa	gaa	gaa	tca	ctt	tct	caa		96
Leu	Thr	Tyr	Pro	Gln	Cys	Ser	Leu	Ser	Lys	Glu	Glu	Ser	Leu	Ser	Gln		
			20					25					30				
tta	caa	gcc	cta	aac	act	ccg	att	aac	aaa	aaa	ttc	ata	aaa	atc	tgc		144
Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys		
		35					40					45					
aga	gag	ctt	cat	gaa	gat	ggg	caa	cct	cac	ctc	cac	gtg	ctt	att	cag		192
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln		
	50					55					60						
ttc	gag	gga	aaa	tac	tgc	tgc	caa	aat	caa	cga	ttc	ttc	gac	ctg	gta		240
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val		
65					70				75					80			
tcc	cca	aca	agg	tca	gca	cat	ttc	cat	cca	aac	att	cag	aga	gct	aaa		288
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys		
				85					90					95			
tcg	tct	tcc	gac	gtc	aag	acg	tac	atc	gac	aaa	gac	gga	gat	act	ctt		336
Ser	Ser	Ser	Asp	Val	Lys	Thr	Tyr	Ile	Asp	Lys	Asp	Gly	Asp	Thr	Leu		
			100					105					110				
gta	tgg	gga	gaa	ttc	cag	gtc	gac	ggt	cga	agt	gct	aga	gga	ggt	tgc		384
Val	Trp	Gly	Glu	Phe	Gln	Val	Asp	Gly	Arg	Ser	Ala	Arg	Gly	Gly	Cys		
		115				120						125					
caa	aca	tct	aac	gac	gct	gca	gca	gag	gcg	tta	aat	gct	tct	tcc	aaa		432
Gln	Thr	Ser	Asn	Asp	Ala	Ala	Ala	Glu	Ala	Leu	Asn	Ala	Ser	Ser	Lys		
	130					135					140						
gaa	gaa	tac	ctt	cag	ata	att	aga	gag	aaa	atc	cca	gaa	aaa	tat	tta		480
Glu	Glu	Tyr	Leu	Gln	Ile	Ile	Arg	Glu	Lys	Ile	Pro	Glu	Lys	Tyr	Leu		
145					150				155						160		
ttt	cag	ttc	cac	aat	cta	aat	agc	aat	tta	gat	agg	ata	ttt	gat	aag		528
Phe	Gln	Phe	His	Asn	Leu	Asn	Ser	Asn	Leu	Asp	Arg	Ile	Phe	Asp	Lys		
				165				170						175			
act	cct	gaa	cca	tgg	ctt	cct	ccg	ttc	cac	gtc	tca	tca	ttt	act	aac		576
Thr	Pro	Glu	Pro	Trp	Leu	Pro	Pro	Phe	His	Val	Ser	Ser	Phe	Thr	Asn		
			180					185					190				
gtg	cca	gac	gag	atg	aga	caa	tgg	gct	gaa	aat	tat	ttt	gga	aag	agt		624
Val	Pro	Asp	Glu	Met	Arg	Gln	Trp	Ala	Glu	Asn	Tyr	Phe	Gly	Lys	Ser		
		195				200						205					
tcc	gct	gcg	cgg	ccg	gag	aga	cct	att	agt	att	atc	atc	gag	ggc	gat		672
Ser	Ala	Ala	Arg	Pro	Glu	Arg	Pro	Ile	Ser	Ile	Ile	Ile	Glu	Gly	Asp		
	210					215					220						
agt	cgg	acg	gga	aag	act	atg	tgg	gct	cgt	tca	cta	ggc	cca	cat	aat		720
Ser	Arg	Thr	Gly	Lys	Thr	Met	Trp	Ala	Arg	Ser	Leu	Gly	Pro	His	Asn		

225	230	235	240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag				768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys				
	245	250	255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg				816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu				
	260	265	270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac				864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn				
	275	280	285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc				912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile				
	290	295	300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac				960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp				
	305	310	315	320
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa				1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys				
	325	330	335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc				1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser				
	340	345	350	

<210> 88  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus  
  
 <400> 88

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1 5 10 15
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln
20 25 30
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys
35 40 45
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln
50 55 60
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val
65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Tyr Leu Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 89  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 L148 mutant

<400> 89  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc 384  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa 432



Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gaa gaa gct gcg cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Glu Glu Ala Ala Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 90

<211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 90

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Ala Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 91  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 L148V mutant

<400> 91  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys 35 40 45	144
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln 50 55 60	192
ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val 65 70 75 80	240
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys 85 90 95	288
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu 100 105 110	336
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys 115 120 125	384
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys 130 135 140	432
gaa gag gcc gtg cag ata att aga gag aaa atc cca gaa aaa tat tta Glu Glu Ala Val Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu 145 150 155 160	480
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys 165 170 175	528
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn 180 185 190	576
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser 195 200 205	624
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp 210 215 220	672
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn 225 230 235 240	720
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys 245 250 255	768
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816

Val	Glu	Tyr	Asn	Val	Ile	Asp	Asp	Val	Thr	Pro	Gln	Tyr	Leu	Lys	Leu		
			260					265					270				
aaa	cat	tgg	aaa	gaa	ctc	att	ggg	gcc	caa	aga	gat	tgg	cag	act	aac	864	
Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn		
		275					280					285					
tgt	aaa	tac	gga	aag	cca	gtt	caa	att	aaa	gga	ggg	atc	ccg	tca	atc	912	
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile		
	290					295				300							
gtg	ctg	tgc	aat	cct	gga	gag	ggg	gct	agc	tat	aaa	gtt	ttc	ctc	gac	960	
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp		
305					310				315						320		
aaa	gag	gaa	aac	act	cca	cta	aag	aac	tgg	act	ttc	cat	aat	gcg	aaa	1008	
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys		
			325					330					335				
ttc	gtc	ttc	ctc	aac	tcc	ccc	ctc	tat	caa	agc	tca	aca	cag	agc	agc	1056	
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser		
		340					345						350				
<210>		92															
<211>		352															
<212>		PRT															
<213>		Tomato golden mosaic virus															
<400>		92															
Met	Pro	Ser	His	Pro	Lys	Arg	Phe	Gln	Ile	Asn	Ala	Lys	Asn	Tyr	Phe		
1				5					10					15			
Leu	Thr	Tyr	Pro	Gln	Cys	Ser	Leu	Ser	Lys	Glu	Glu	Ser	Leu	Ser	Gln		
			20					25					30				
Leu	Gln	Ala	Leu	Asn	Thr	Pro	Ile	Asn	Lys	Lys	Phe	Ile	Lys	Ile	Cys		
		35					40					45					
Arg	Glu	Leu	His	Glu	Asp	Gly	Gln	Pro	His	Leu	His	Val	Leu	Ile	Gln		
	50					55					60						
Phe	Glu	Gly	Lys	Tyr	Cys	Cys	Gln	Asn	Gln	Arg	Phe	Phe	Asp	Leu	Val		
65					70				75					80			
Ser	Pro	Thr	Arg	Ser	Ala	His	Phe	His	Pro	Asn	Ile	Gln	Arg	Ala	Lys		
				85					90					95			
Ser	Ser	Ser	Asp	Val	Lys	Thr	Tyr	Ile	Asp	Lys	Asp	Gly	Asp	Thr	Leu		
			100					105					110				

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140

Glu Glu Ala Val Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175

Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205

Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220

Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
 260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
 275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 93  
 <211> 1056  
 <212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 L148V\* mutant

<400> 93  
 atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc 384  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa 432  
 Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140  
 gaa gaa gcc gtt cag ata att aga gag aaa atc cca gaa aaa tat tta 480  
 Glu Glu Ala Val Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160

ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 94  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 94

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe



1	5	10	15
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln	20	25	30
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys	35	40	45
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln	50	55	60
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	65	70	75
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	85	90	95
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	100	105	110
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	115	120	125
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	130	135	140
Glu Glu Ala Val Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	145	150	155
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	165	170	175
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	180	185	190
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	195	200	205
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	210	215	220
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	225	230	235
			240

Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
245 250 255

Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu  
260 265 270

Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn  
275 280 285

Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
290 295 300

Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
305 310 315 320

Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
325 330 335

Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
340 345 350

<210> 95  
<211> 1056  
<212> DNA  
<213> Tomato golden mosaic virus

<220>  
<221> CDS  
<222> (1)..(1056)  
<223> TGMV AL1 L148G mutant

<400> 95  
atg cca tcg cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
1 5 10 15  
ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
20 25 30  
tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
35 40 45  
aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
50 55 60

ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta	240
Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val	
65 70 75 80	
tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa	288
Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys	
85 90 95	
tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt	336
Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu	
100 105 110	
gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc	384
Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys	
115 120 125	
caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa	432
Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys	
130 135 140	
gaa gaa gcc ggc cag ata att aga gag aaa atc cca gaa aaa tat tta	480
Glu Glu Ala Gly Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu	
145 150 155 160	
ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag	528
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys	
165 170 175	
act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac	576
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn	
180 185 190	
gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	

tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc 912  
 Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile  
 290 295 300

gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac 960  
 Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp  
 305 310 315 320

aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa 1008  
 Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys  
 325 330 335

ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc 1056  
 Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser  
 340 345 350

<210> 96

<211> 352

<212> PRT

<213> Tomato golden mosaic virus

<400> 96

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45

Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60

Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80

Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95

Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110

Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125

Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys

130		135		140
Glu Glu Ala Gly Gln Ile Ile Arg Glu Lys Ile Pro Glu Lys Tyr Leu				
145		150		155
				160
Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys				
		165		170
				175
Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn				
		180		185
				190
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser				
		195		200
				205
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp				
		210		215
				220
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn				
		225		230
				235
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys				
		245		250
				255
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu				
		260		265
				270
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn				
		275		280
				285
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile				
		290		295
				300
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp				
		305		310
				315
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys				
		325		330
				335
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser				
		340		345
				350

<210> 97  
 <211> 1056

<212> DNA  
 <213> Tomato golden mosaic virus

<220>  
 <221> CDS  
 <222> (1)..(1056)  
 <223> TGMV AL1 III151 mutant

<400> 97  
 atg cca tgc cat cca aaa cgg ttt caa ata aat gcc aaa aat tat ttt 48  
 Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe  
 1 5 10 15  
 ctt aca tat cct cag tgc tcc ttg tcc aaa gaa gaa tca ctt tct caa 96  
 Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln  
 20 25 30  
 tta caa gcc cta aac act ccg att aac aaa aaa ttc ata aaa atc tgc 144  
 Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 aga gag ctt cat gaa gat ggg caa cct cac ctc cac gtg ctt att cag 192  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 ttc gag gga aaa tac tgc tgc caa aat caa cga ttc ttc gac ctg gta 240  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 tcc cca aca agg tca gca cat ttc cat cca aac att cag aga gct aaa 288  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 tcg tct tcc gac gtc aag acg tac atc gac aaa gac gga gat act ctt 336  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 gta tgg gga gaa ttc cag gtc gac ggt cga agt gct aga gga ggt tgc 384  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 caa aca tct aac gac gct gca gca gag gcg tta aat gct tct tcc aaa 432  
 Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140  
 gaa gaa gcc ctt cag gca gct aga gag aaa atc cca gaa aaa tat tta 480  
 Glu Glu Ala Leu Gln Ala Ala Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160  
 ttt cag ttc cac aat cta aat agc aat tta gat agg ata ttt gat aag 528  
 Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175  
 act cct gaa cca tgg ctt cct ccg ttc cac gtc tca tca ttt act aac 576  
 Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190

gtg cca gac gag atg aga caa tgg gct gaa aat tat ttt gga aag agt	624
Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser	
195 200 205	
tcc gct gcg cgg ccg gag aga cct att agt att atc atc gag ggc gat	672
Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp	
210 215 220	
agt cgg acg gga aag act atg tgg gct cgt tca cta ggc cca cat aat	720
Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn	
225 230 235 240	
tat ttg agc ggg cat ttg gat ctc aat tct agg gtt tac tca aac aag	768
Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys	
245 250 255	
gtt gag tat aac gtc atc gat gat gtc aca ccg caa tat cta aag ttg	816
Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu	
260 265 270	
aaa cat tgg aaa gaa ctc att ggg gcc caa aga gat tgg cag act aac	864
Lys His Trp Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Thr Asn	
275 280 285	
tgt aaa tac gga aag cca gtt caa att aaa gga ggt atc ccg tca atc	912
Cys Lys Tyr Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile	
290 295 300	
gtg ctg tgc aat cct gga gag ggt gct agc tat aaa gtt ttc ctc gac	960
Val Leu Cys Asn Pro Gly Glu Gly Ala Ser Tyr Lys Val Phe Leu Asp	
305 310 315 320	
aaa gag gaa aac act cca cta aag aac tgg act ttc cat aat gcg aaa	1008
Lys Glu Glu Asn Thr Pro Leu Lys Asn Trp Thr Phe His Asn Ala Lys	
325 330 335	
ttc gtc ttc ctc aac tcc ccc ctc tat caa agc tca aca cag agc agc	1056
Phe Val Phe Leu Asn Ser Pro Leu Tyr Gln Ser Ser Thr Gln Ser Ser	
340 345 350	

<210> 98  
 <211> 352  
 <212> PRT  
 <213> Tomato golden mosaic virus

<400> 98

Met Pro Ser His Pro Lys Arg Phe Gln Ile Asn Ala Lys Asn Tyr Phe
1 5 10 15

Leu Thr Tyr Pro Gln Cys Ser Leu Ser Lys Glu Glu Ser Leu Ser Gln
20 25 30

Leu Gln Ala Leu Asn Thr Pro Ile Asn Lys Lys Phe Ile Lys Ile Cys  
 35 40 45  
 Arg Glu Leu His Glu Asp Gly Gln Pro His Leu His Val Leu Ile Gln  
 50 55 60  
 Phe Glu Gly Lys Tyr Cys Cys Gln Asn Gln Arg Phe Phe Asp Leu Val  
 65 70 75 80  
 Ser Pro Thr Arg Ser Ala His Phe His Pro Asn Ile Gln Arg Ala Lys  
 85 90 95  
 Ser Ser Ser Asp Val Lys Thr Tyr Ile Asp Lys Asp Gly Asp Thr Leu  
 100 105 110  
 Val Trp Gly Glu Phe Gln Val Asp Gly Arg Ser Ala Arg Gly Gly Cys  
 115 120 125  
 Gln Thr Ser Asn Asp Ala Ala Ala Glu Ala Leu Asn Ala Ser Ser Lys  
 130 135 140  
 Glu Glu Ala Leu Gln Ala Ala Arg Glu Lys Ile Pro Glu Lys Tyr Leu  
 145 150 155 160  
 Phe Gln Phe His Asn Leu Asn Ser Asn Leu Asp Arg Ile Phe Asp Lys  
 165 170 175  
 Thr Pro Glu Pro Trp Leu Pro Pro Phe His Val Ser Ser Phe Thr Asn  
 180 185 190  
 Val Pro Asp Glu Met Arg Gln Trp Ala Glu Asn Tyr Phe Gly Lys Ser  
 195 200 205  
 Ser Ala Ala Arg Pro Glu Arg Pro Ile Ser Ile Ile Ile Glu Gly Asp  
 210 215 220  
 Ser Arg Thr Gly Lys Thr Met Trp Ala Arg Ser Leu Gly Pro His Asn  
 225 230 235 240  
 Tyr Leu Ser Gly His Leu Asp Leu Asn Ser Arg Val Tyr Ser Asn Lys  
 245 250 255  
 Val Glu Tyr Asn Val Ile Asp Asp Val Thr Pro Gln Tyr Leu Lys Leu



	260		265		270										
Lys	His	Trp	Lys	Glu	Leu	Ile	Gly	Ala	Gln	Arg	Asp	Trp	Gln	Thr	Asn
	275						280					285			
Cys	Lys	Tyr	Gly	Lys	Pro	Val	Gln	Ile	Lys	Gly	Gly	Ile	Pro	Ser	Ile
	290					295					300				
Val	Leu	Cys	Asn	Pro	Gly	Glu	Gly	Ala	Ser	Tyr	Lys	Val	Phe	Leu	Asp
305					310					315					320
Lys	Glu	Glu	Asn	Thr	Pro	Leu	Lys	Asn	Trp	Thr	Phe	His	Asn	Ala	Lys
				325					330					335	
Phe	Val	Phe	Leu	Asn	Ser	Pro	Leu	Tyr	Gln	Ser	Ser	Thr	Gln	Ser	Ser
			340					345					350		

<210> 99  
 <211> 25  
 <212> PRT  
 <213> Tomato golden mosaic virus

<220>  
 <221> MISC\_FEATURE  
 <222> (1)..(25)  
 <223> Amino acids 132-156 of TGMV AL1

<400> 99

Asn	Asp	Ala	Ala	Ala	Glu	Ala	Leu	Asn	Ala	Ser	Ser	Lys	Glu	Glu	Ala
1				5					10					15	

Leu	Gln	Ile	Ile	Arg	Glu	Lys	Ile	Pro
		20					25	

<210> 100  
 <211> 13  
 <212> PRT  
 <213> Tomato golden mosaic virus

<220>  
 <221> MISC\_FEATURE  
 <222> (1)..(13)  
 <223> TGMV AL1 amino acids 144-156

<400> 100

Lys Glu Glu Ala Leu Gln Ile Ile Arg Glu Lys Ile Pro  
1 5 10

<210> 101  
<211> 13  
<212> PRT  
<213> tomato yellow leaf curl virus

<220>  
<221> MISC\_FEATURE  
<222> (1)..(13)  
<223> TYLCV C1 amino acids 142-154

<400> 101

Lys Ser Glu Ala Leu Lys Ile Leu Arg Glu Leu Ala Pro  
1 5 10

<210> 102  
<211> 13  
<212> PRT  
<213> cabbage leaf curl virus

<220>  
<221> MISC\_FEATURE  
<222> (1)..(13)  
<223> CbLCV AL1 amino acids 141-153

<400> 102

Val Glu Glu Ala Leu Ala Ile Ile Arg Ala Gly Asp Pro  
1 5 10

<210> 103  
<211> 27  
<212> DNA  
<213> Artificial sequence

<220>  
<223> Synthetic oligonucleotide primer

<400> 103  
ggacaccgat tggatccagc atgcctc

27

<210> 104  
<211> 27  
<212> DNA  
<213> Artificial sequence

<220>  
<223> Synthetic oligonucleotide primer

<400> 104  
ccacagtcga attccccggg cttacgc 27

<210> 105  
<211> 36  
<212> DNA  
<213> Artificial sequence

<220>  
<223> Mutagenesis oligonucleotide

<400> 105  
cctaaataag atctacaagg atcccacgaa acccta 36

<210> 106  
<211> 31  
<212> DNA  
<213> Artificial sequence

<220>  
<223> CbLCV AL1 L145A mutagenesis oligonucleotide

<400> 106  
gtgtggaaga ggcggccgca attataaggg c 31

<210> 107  
<211> 349  
<212> PRT  
<213> cabbage leaf curl virus

<400> 107

Met Pro Arg Asn Pro Lys Ser Phe Arg Leu Ala Ala Arg Asn Ile Phe  
1 5 10 15

Leu Thr Tyr Pro Gln Cys Asp Ile Pro Lys Asp Glu Ala Leu Gln Met  
20 25 30

Leu Gln Thr Leu Ser Trp Ser Val Val Lys Pro Thr Tyr Ile Arg Val  
35 40 45

Ala Arg Glu Glu His Ser Asp Gly Phe Pro His Leu His Cys Leu Ile  
50 55 60

Gln Leu Ser Gly Lys Ser Asn Ile Lys Asp Ala Arg Phe Phe Asp Ile  
65 70 75 80

Thr His Pro Arg Arg Ser Ala Asn Phe His Pro Asn Ile Gln Ala Ala

85

90

95

Lys Asp Thr Asn Ala Val Lys Asn Tyr Ile Thr Lys Asp Gly Asp Tyr  
 100 105 110

Cys Glu Ser Gly Gln Tyr Lys Val Ser Gly Gly Thr Lys Ala Asn Lys  
 115 120 125

Asp Asp Val Tyr His Asn Ala Val Asn Ala Gly Cys Val Glu Glu Ala  
 130 135 140

Leu Ala Ile Ile Arg Ala Gly Asp Pro Lys Thr Phe Ile Val Ser Tyr  
 145 150 155 160

His Asn Val Arg Ala Asn Ile Glu Arg Leu Phe Thr Lys Ala Pro Glu  
 165 170 175

Pro Trp Ala Pro Pro Phe Gln Leu Ser Ser Phe Thr Asn Val Pro Asp  
 180 185 190

Glu Met Ser Ser Trp Ala Asp Asp Tyr Phe Gly Arg Ser Ala Ala Ala  
 195 200 205

Arg Ala Glu Arg Pro Ile Ser Ile Ile Val Glu Gly Asp Ser Arg Thr  
 210 215 220

Gly Lys Thr Met Trp Ala Arg Ala Leu Gly Pro His Asn Tyr Leu Ser  
 225 230 235 240

Gly His Leu Asp Phe Asn Ser Lys Val Phe Ser Asn Asn Ala Glu Tyr  
 245 250 255

Asn Val Ile Asp Asp Ile Ala Pro His Tyr Leu Lys Leu Lys His Trp  
 260 265 270

Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Ser Asn Cys Lys Tyr  
 275 280 285

Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile Val Leu Cys  
 290 295 300

Asn Pro Gly Glu Gly Ser Ser Tyr Ile Ser Phe Leu Asn Lys Glu Glu  
 305 310 315 320

Asn Ala Ser Leu Arg Ala Trp Thr Thr Lys Asn Ala Lys Phe Ile Thr  
 325 330 335

Leu Glu Ala Pro Leu Tyr Gln Ser Thr Ala Gln Asp Cys  
 340 345

<210> 108  
 <211> 70  
 <212> PRT  
 <213> cabbage leaf curl virus

<220>  
 <221> MISC\_FEATURE  
 <222> (1)..(70)  
 <223> Wild-type CbLCV AL1 amino acids 111-180  
 <400> 108

Asp Tyr Cys Glu Ser Gly Gln Tyr Lys Val Ser Gly Gly Thr Lys Ala  
 1 5 10 15

Asn Lys Asp Asp Val Tyr His Asn Ala Val Asn Ala Gly Cys Val Glu  
 20 25 30

Glu Ala Leu Ala Ile Ile Arg Ala Gly Asp Pro Lys Thr Phe Ile Val  
 35 40 45

Ser Tyr His Asn Val Arg Ala Asn Ile Glu Arg Leu Phe Thr Lys Ala  
 50 55 60

Pro Glu Pro Trp Ala Pro  
 65 70

<210> 109  
 <211> 70  
 <212> PRT  
 <213> cabbage leaf curl virus

<220>  
 <221> MISC\_FEATURE  
 <222> (35)..(35)  
 <223> L145A mutation

<400> 109

Asp Tyr Cys Glu Ser Gly Gln Tyr Lys Val Ser Gly Gly Thr Lys Ala



gacatagctc cgcattatct aaagctaaag cactggaaaag agcttattgg ggcccaaagg 840  
gactggcaat caaactgtaa gtacggcaag ccagttcaaa ttaaagggtgg cataccctca 900  
atcgtgctgt gcaatccagg agaggggagc agttatataa gtttcctcaa caaagaggaa 960  
aatgcatcac taagagcgtg gactaccaa aatgcaaaat tcatcactct tgaagccccc 1020  
ctctatcaaa gcacagcaca agattgc 1047

<210> 111  
<211> 1047  
<212> DNA  
<213> cabbage leaf curl virus

<220>  
<221> CDS  
<222> (1)..(1047)  
<223> CbLCV AL1 L145A mutation

<400> 111  
atg cca cga aac cct aaa tcg ttt cgt tta gca gcc cga aat ata ttc 48  
Met Pro Arg Asn Pro Lys Ser Phe Arg Leu Ala Ala Arg Asn Ile Phe  
1 5 10 15  
tta aca tat ccc cag tgc gac ata ccc aaa gat gaa gct ctt cag atg 96  
Leu Thr Tyr Pro Gln Cys Asp Ile Pro Lys Asp Glu Ala Leu Gln Met  
20 25 30  
ctt caa acc ctg tcg tgg tca gtc gtc aaa ccc aca tac atc aga gtc 144  
Leu Gln Thr Leu Ser Trp Ser Val Val Lys Pro Thr Tyr Ile Arg Val  
35 40 45  
gca aga gag gaa cat tca gac ggg ttc ccc cat tta cac tgt ctc atc 192  
Ala Arg Glu Glu His Ser Asp Gly Phe Pro His Leu His Cys Leu Ile  
50 55 60  
caa cta tca gga aag tcg aac atc aag gat gct aga ttt ttc gac atc 240  
Gln Leu Ser Gly Lys Ser Asn Ile Lys Asp Ala Arg Phe Phe Asp Ile  
65 70 75 80  
act cac ccc aga agg tct gcc aat ttt cac cca aac att cag gca gcc 288  
Thr His Pro Arg Arg Ser Ala Asn Phe His Pro Asn Ile Gln Ala Ala  
85 90 95  
aaa gac acc aat gcc gtc aag aat tac atc acc aaa gat ggt gat tat 336  
Lys Asp Thr Asn Ala Val Lys Asn Tyr Ile Thr Lys Asp Gly Asp Tyr  
100 105 110  
tgt gaa tcc ggg cag tac aag gtg tct ggg ggt aca aag gca aat aaa 384  
Cys Glu Ser Gly Gln Tyr Lys Val Ser Gly Gly Thr Lys Ala Asn Lys  
115 120 125  
gac gac gtc tac cac aac gcc gtc aat gcg gga tgt gtg gaa gag gcg 432  
Asp Asp Val Tyr His Asn Ala Val Asn Ala Gly Cys Val Glu Glu Ala

130	135	140	
gcc gca att ata agg gct gga gat cca aag acg ttc att gtt agt tat Ala Ala Ile Ile Arg Ala Gly Asp Pro Lys Thr Phe Ile Val Ser Tyr 145 150 155 160			480
cat aat gtt aga gct aac ata gag cga ctc ttt act aag gct ccg gaa His Asn Val Arg Ala Asn Ile Glu Arg Leu Phe Thr Lys Ala Pro Glu 165 170 175			528
cca tgg gct cct ccg ttt caa ctc tcc tcc ttt act aac gtc ccg gac Pro Trp Ala Pro Pro Phe Gln Leu Ser Ser Phe Thr Asn Val Pro Asp 180 185 190			576
gag atg agt tca tgg gca gat gac tat ttt ggt cgg agt gcc gct gcg Glu Met Ser Ser Trp Ala Asp Asp Tyr Phe Gly Arg Ser Ala Ala Ala 195 200 205			624
cgg gcg gaa aga cct att agt atc ata gtt gaa ggt gat tca cga acc Arg Ala Glu Arg Pro Ile Ser Ile Ile Val Glu Gly Asp Ser Arg Thr 210 215 220			672
ggc aag acc atg tgg gcg cgt gct tta gga cca cat aat tat ttg agt Gly Lys Thr Met Trp Ala Arg Ala Leu Gly Pro His Asn Tyr Leu Ser 225 230 235 240			720
ggg cac ctc gac ttt aat tca aag gtc ttt tca aat aat gcg gag tat Gly His Leu Asp Phe Asn Ser Lys Val Phe Ser Asn Asn Ala Glu Tyr 245 250 255			768
aac gtc att gat gac ata gct ccg cat tat cta aag cta aag cac tgg Asn Val Ile Asp Asp Ile Ala Pro His Tyr Leu Lys Leu Lys His Trp 260 265 270			816
aaa gag ctt att ggg gcc caa agg gac tgg caa tca aac tgt aag tac Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Ser Asn Cys Lys Tyr 275 280 285			864
ggc aag cca gtt caa att aaa ggt ggc ata ccc tca atc gtg ctg tgc Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile Val Leu Cys 290 295 300			912
aat cca gga gag ggg agc agt tat ata agt ttc ctc aac aaa gag gaa Asn Pro Gly Glu Gly Ser Ser Tyr Ile Ser Phe Leu Asn Lys Glu Glu 305 310 315 320			960
aat gca tca cta aga gcg tgg act acc aaa aat gca aaa ttc atc act Asn Ala Ser Leu Arg Ala Trp Thr Thr Lys Asn Ala Lys Phe Ile Thr 325 330 335			1008
ctt gaa gcc ccc ctc tat caa agc aca gca caa gat tgc Leu Glu Ala Pro Leu Tyr Gln Ser Thr Ala Gln Asp Cys 340 345			1047

<210> 112

<211> 349



<212> PRT

<213> cabbage leaf curl virus

<400> 112

Met Pro Arg Asn Pro Lys Ser Phe Arg Leu Ala Ala Arg Asn Ile Phe  
1 5 10 15

Leu Thr Tyr Pro Gln Cys Asp Ile Pro Lys Asp Glu Ala Leu Gln Met  
20 25 30

Leu Gln Thr Leu Ser Trp Ser Val Val Lys Pro Thr Tyr Ile Arg Val  
35 40 45

Ala Arg Glu Glu His Ser Asp Gly Phe Pro His Leu His Cys Leu Ile  
50 55 60

Gln Leu Ser Gly Lys Ser Asn Ile Lys Asp Ala Arg Phe Phe Asp Ile  
65 70 75 80

Thr His Pro Arg Arg Ser Ala Asn Phe His Pro Asn Ile Gln Ala Ala  
85 90 95

Lys Asp Thr Asn Ala Val Lys Asn Tyr Ile Thr Lys Asp Gly Asp Tyr  
100 105 110

Cys Glu Ser Gly Gln Tyr Lys Val Ser Gly Gly Thr Lys Ala Asn Lys  
115 120 125

Asp Asp Val Tyr His Asn Ala Val Asn Ala Gly Cys Val Glu Glu Ala  
130 135 140

Ala Ala Ile Ile Arg Ala Gly Asp Pro Lys Thr Phe Ile Val Ser Tyr  
145 150 155 160

His Asn Val Arg Ala Asn Ile Glu Arg Leu Phe Thr Lys Ala Pro Glu  
165 170 175

Pro Trp Ala Pro Pro Phe Gln Leu Ser Ser Phe Thr Asn Val Pro Asp  
180 185 190

Glu Met Ser Ser Trp Ala Asp Asp Tyr Phe Gly Arg Ser Ala Ala Ala  
195 200 205

Arg Ala Glu Arg Pro Ile Ser Ile Ile Val Glu Gly Asp Ser Arg Thr  
 210 215 220

Gly Lys Thr Met Trp Ala Arg Ala Leu Gly Pro His Asn Tyr Leu Ser  
 225 230 235 240

Gly His Leu Asp Phe Asn Ser Lys Val Phe Ser Asn Asn Ala Glu Tyr  
 245 250 255

Asn Val Ile Asp Asp Ile Ala Pro His Tyr Leu Lys Leu Lys His Trp  
 260 265 270

Lys Glu Leu Ile Gly Ala Gln Arg Asp Trp Gln Ser Asn Cys Lys Tyr  
 275 280 285

Gly Lys Pro Val Gln Ile Lys Gly Gly Ile Pro Ser Ile Val Leu Cys  
 290 295 300

Asn Pro Gly Glu Gly Ser Ser Tyr Ile Ser Phe Leu Asn Lys Glu Glu  
 305 310 315 320

Asn Ala Ser Leu Arg Ala Trp Thr Thr Lys Asn Ala Lys Phe Ile Thr  
 325 330 335

Leu Glu Ala Pro Leu Tyr Gln Ser Thr Ala Gln Asp Cys  
 340 345

<210> 113  
 <211> 13  
 <212> PRT  
 <213> Artificial

<220>  
 <223> Consensus begomovirus AL1/C1 sequence

<220>  
 <221> MISC\_FEATURE  
 <222> (1)..(3)  
 <223> Xaa can be any naturally occurring amino acid, but is generally a charged amino acid which is optionally present or absent

<220>  
 <221> MISC\_FEATURE  
 <222> (5)..(5)  
 <223> Xaa can be Leu or Met

<220>

<221> misc\_feature  
 <222> (6)..(6)  
 <223> Xaa can be any naturally occurring amino acid

<220>  
 <221> MISC\_FEATURE  
 <222> (7)..(7)  
 <223> Xaa can be Ile or Val

<220>  
 <221> MISC\_FEATURE  
 <222> (8)..(8)  
 <223> Xaa can be Ile or Leu

<220>  
 <221> MISC\_FEATURE  
 <222> (9)..(9)  
 <223> Xaa can be Arg or Lys

<220>  
 <221> MISC\_FEATURE  
 <222> (10)..(10)  
 <223> Xaa can be Glu or Asp

<220>  
 <221> misc\_feature  
 <222> (11)..(12)  
 <223> Xaa can be any naturally occurring amino acid

<400> 113

Xaa Xaa Xaa Ala Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Pro  
 1 5 10